About Non-Small Cell Lung Cancer

Overview and Types

If you have been diagnosed with non-small cell lung cancer or are worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- What Is Non-Small Cell Lung Cancer?

Research and Statistics

See the latest estimates for new cases of non-small cell lung cancer and deaths in the US and what research is currently being done.

- Key Statistics for Lung Cancer
- What's New in Non-Small Cell Lung Cancer Research?

What Is Non-Small Cell Lung Cancer?

Lung cancer starts when cells of the lung become abnormal and begin to grow out of control. As more cancer cells develop, they can form into a tumor and spread to other areas of the body. To learn more about how cancers start and spread, see What Is Cancer?

Types of non-small cell lung cancer

There are 2 main types of lung cancer:

- About 80% to 85% of lung cancers are **non-small cell lung cancer (NSCLC)**
- About 10% to 15% are **small cell lung cancer (SCLC)**

These types of lung cancer are treated very differently. **This information covers only**

non-small cell lung cancer.

There are subtypes of NSCLC, which start from different types of lung cells. But they are grouped together as NSCLC because the approach to treatment and prognosis (outlook) are often similar.

Adenocarcinoma: About 40% of lung cancers are adenocarcinomas. These cancers start in early versions of the cells that would normally secrete substances such as mucus.

This type of lung cancer occurs mainly in current or former smokers, but it is also the most common type of lung cancer seen in non-smokers. It is more common in women than in men, and it is more likely to occur in younger people than other types of lung cancer.

Adenocarcinoma is usually found in outer parts of the lung. Though it tends to grow slower than other types of lung cancer and is more likely to be found before it has spread, this varies from patient to patient.

People with a type of adenocarcinoma called *adenocarcinoma in situ* (previously called *bronchioloalveolar carcinoma*) tend to have a better outlook than those with other types of lung cancer.

Squamous cell (epidermoid) carcinoma: About 25% to 30% of all lung cancers are squamous cell carcinomas. These cancers start in early versions of squamous cells, which are flat cells that line the inside of the airways in the lungs. They are often linked to a history of smoking and tend to be found in the central part of the lungs, near a main airway (bronchus).

Large cell (undifferentiated) carcinoma: This type accounts for about 10% to 15% of lung cancers. It can appear in any part of the lung. It tends to grow and spread quickly, which can make it harder to treat. A subtype of large cell carcinoma, known as *large cell neuroendocrine carcinoma*, is a fast-growing cancer that is very similar to small cell lung cancer.

Other subtypes: A few other subtypes of NSCLC, such as adenosquamous carcinoma and sarcomatoid carcinoma, are much less common.

Other types of lung tumors

Along with the 2 main types of lung cancer, other tumors can occur in the lungs.

Lung carcinoid tumors: Carcinoid tumors of the lung account for fewer than 5% of lung tumors. Most of these grow slowly. For more information about these tumors, see Lung Carcinoid Tumor.

Other lung tumors: Other types of lung cancer such as adenoid cystic carcinomas, lymphomas, and sarcomas, as well as benign lung tumors such as hamartomas are rare. These are treated differently from the more common lung cancers and are not discussed here.

Cancers that spread to the lungs: Cancers that start in other organs (such as the breast, pancreas, kidney, or skin) can sometimes spread (metastasize) to the lungs, but these are not lung cancers. For example, cancer that starts in the breast and spreads to the lungs is still breast cancer, not lung cancer. Treatment for metastatic cancer to the lungs is based on where it started (the primary cancer site).

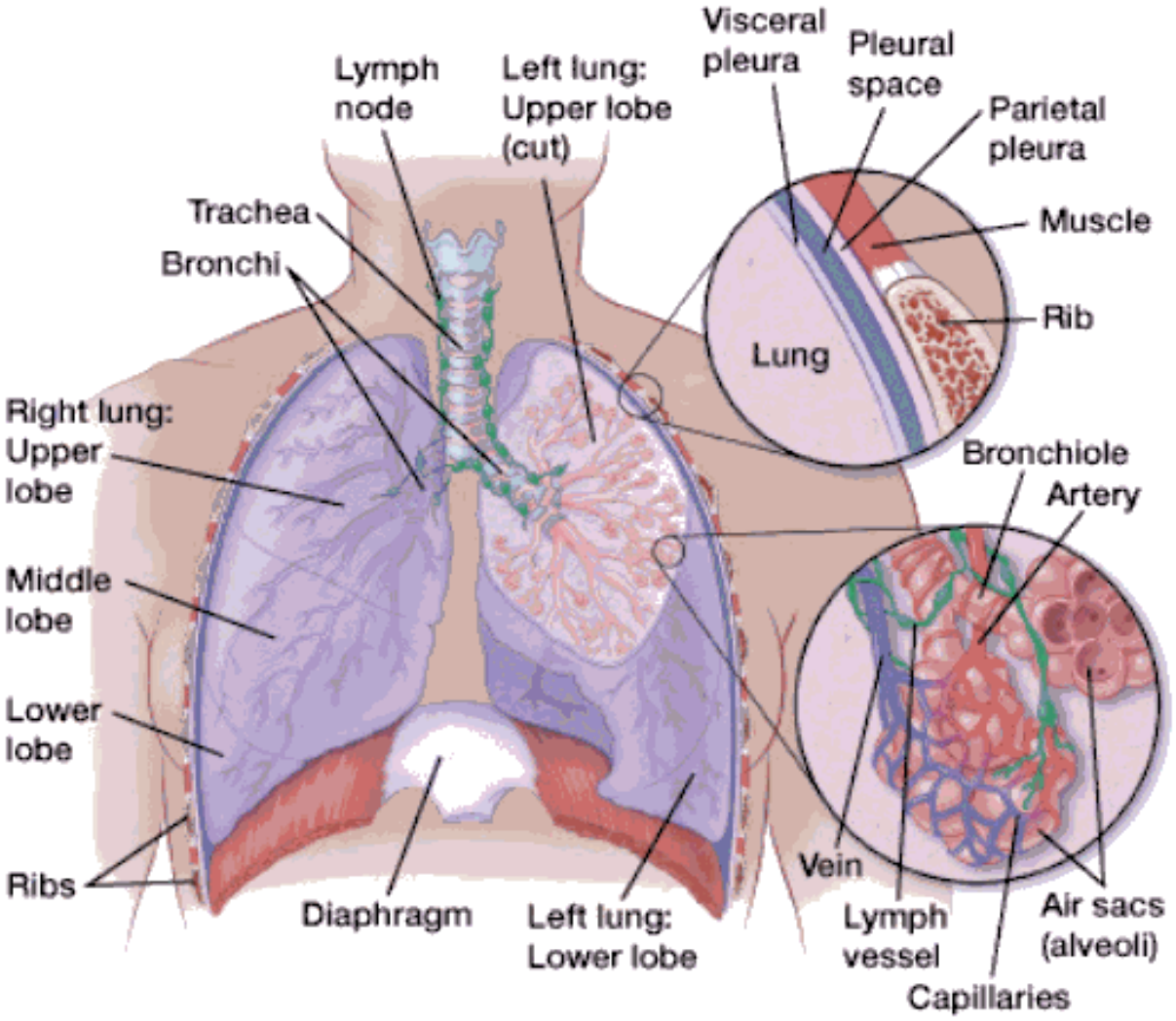
How the lungs function

Your lungs are 2 sponge-like organs in your chest. Your right lung has 3 sections, called *lobes*. Your left lung has 2 lobes. The left lung is smaller because the heart takes up more room on that side of the body.

When you breathe in, air enters through your mouth or nose and goes into your lungs through the *trachea* (windpipe). The trachea divides into tubes called *bronchi* (singular, *bronchus*), which enter the lungs and divide into smaller bronchi. These divide to form smaller branches called *bronchioles*. At the end of the bronchioles are tiny air sacs known as *alveoli*.

The alveoli absorb oxygen from the inhaled air into your blood and remove carbon dioxide from the blood. This is expelled from the body when you exhale. Taking in oxygen and getting rid of carbon dioxide are your lungs' main functions.

Lung cancers typically start in the cells lining the bronchi and parts of the lung such as the bronchioles or alveoli.



A thin lining layer called the *pleura* surrounds the lungs. The pleura protects your lungs and helps them slide back and forth against the chest wall as they expand and contract during breathing.

Below the lungs, a thin, dome-shaped muscle called the *diaphragm* separates the chest from the abdomen. When you breathe, the diaphragm moves up and down, forcing air in and out of the lungs.

- References

See all references for Non-Small Cell Lung Cancer

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Key Statistics for Lung Cancer

Most lung cancer statistics include both small cell and non-small cell lung cancers.

How common is lung cancer?

Lung cancer (both small cell and non-small cell) is the second most common cancer in both men and women (not counting skin cancer). In men, prostate cancer is more common, while in women breast cancer is more common. About 14% of all new cancers are lung cancers.

The American Cancer Society's estimates for lung cancer in the United States for 2018 are:

- About 234,030 new cases of lung cancer (121,680 in men and 112,350 in women)
- About 154,050 deaths from lung cancer (83,550 in men and 70,500 in women)

Lung cancer is by far the leading cause of cancer death among both men and women Each year, more people die of lung cancer than of colon, breast, and prostate cancers combined.

Lung cancer mainly occurs in older people. Mostpeople diagnosed with lung cancer are 65 or older, while a very small number of people diagnosed younger than 45. The average age at the time of diagnosis is about 70.

Lifetime chance of getting lung cancer

Overall, the chance that a man will develop lung cancer in his lifetime is about 1 in 15; for a woman, the risk is about 1 in 17. These numbers include both smokers and non-smokers. For smokers the risk is much higher, while for non-smokers the risk is lower.

Black men are about 20% more likely to develop lung cancer than white men. The rate is about 10% lower in black women than in white women. Both black and white women have lower rates than men, but the gap is closing. The lung cancer rate has been dropping among men over the past few decades, but only for about the last decade in women.

Statistics on survival in people with lung cancer vary depending on the stage (extent) of the cancer when it is diagnosed. For survival statistics based on the stage of the cancer, see Non-Small Cell Lung Cancer Survival Rates By Stage.

Despite the very serious prognosis (outlook) of lung cancer, some people with earlier stage cancers are cured. More than 430,000 people alive today have been diagnosed with lung cancer at some point.

Visit the American Cancer Society'sCancer Statistics Center for more key statistics.

- References

American Cancer Society. *Facts & Figures 2018*. American Cancer Society. Atlanta, Ga. 2018.

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Cancer Stat Facts: Lung and bronchus cancer, 2010-2014. National Cancer Institute, Bethesda, MD. https://seer.cancer.gov/statfacts/html/lungb.html. Accessed on January 5, 2018.

See all references for Non-Small Cell Lung Cancer

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What's New in Non-Small Cell Lung Cancer Research?

Research into the prevention, early detection, and treatment of lung cancer is being done in many medical centers throughout the world.

Prevention

Tobacco

Prevention offers the greatest opportunity to fight lung cancer. Although decades have passed since the link between smoking and lung cancers became clear, smoking is still responsible for most lung cancer deaths. Research is continuing on:

- Ways to help people quit smoking and stay tobacco-free through counseling, nicotine replacement, and other medicines
- Ways to convince young people to never start smoking
- Inherited differences in genes that may make some people much more likely to get lung cancer if they smoke or are exposed to someone else's smoke

Environmental causes

Researchers also continue to look into some of the other causes of lung cancer, such as exposure to radon and diesel exhaust. Finding new ways to limit these exposures could potentially save many more lives.

Diet, nutrition, and medicines

Researchers are looking for ways to use vitamins or medicines to prevent lung cancer in people at high risk, but so far none have been shown to clearly reduce risk.

Some studies have suggested that a diet high in fruits and vegetables may offer some protection, but more research is needed to confirm this. While any protective effect of fruits and vegetables on lung cancer risk is likely to be much smaller than the increased risk from smoking, following the American Cancer Society dietary recommendations (such as staying at a healthy weight and eating a diet high in fruits, vegetables, and whole grains) may still be helpful.

Early detection

As mentioned in Can Non-Small Cell Lung Cancer Be Found Early?, screening with spiral CT scans in people at high risk of lung cancer (due to smoking history) lowers the risk of death from lung cancer, when compared to chest x-rays.

Another approach now being studied uses newer, sensitive tests to look for cancer cells in sputum samples. Researchers have found several changes often seen in the DNA of lung cancer cells. Studies are looking at tests that can spot these DNA changes to see if they can find lung cancers at an earlier stage.

Diagnosis

Fluorescence bronchoscopy

Also known as *autofluorescence bronchoscopy*, this technique might help doctors find some lung cancers earlier, when they are likely to be easier to treat. For this test, the doctor inserts a bronchoscope through the mouth or nose and into the lungs. The end of the bronchoscope has a special fluorescent light on it, instead of a normal (white) light.

The fluorescent light causes abnormal areas in the airways to show up in a different color than healthy parts of the airway. Some of these areas might not be visible under white light, so the color difference can help doctors find these areas sooner. Some cancer centers now use this technique to look for early lung cancers, especially if there are no obvious tumors seen with normal bronchoscopy.

Virtual bronchoscopy

This imaging test uses a chest CT scan to create a detailed 3-dimensional picture of the airways in the lungs. The images can be viewed as if the doctor were actually using a bronchoscope.

Virtual bronchoscopy has some possible advantages over standard bronchoscopy. First, it is non-invasive and doesn't require anesthesia. It also helps doctors view some airways that they might not able to get to with standard bronchoscopy, such as those being blocked by a tumor. But this test has some drawbacks as well. For example, it doesn't show color changes in the airways that might indicate a problem. It also doesn't let a doctor take samples of suspicious areas like bronchoscopy does. Still, it can be a useful tool in some situations, such as in people who might be too sick to get a standard bronchoscopy.

This test will probably become more available as the technology improves.

Electromagnetic navigation bronchoscopy

Lung tumors near the center of the chest can be biopsied during bronchoscopy, but

bronchoscopes have trouble reaching the outer parts of the lungs, so tumors in these areas often need to be biopsied using a needle passed through the skin.

This newer approach can help a doctor use a bronchoscope to biopsy a tumor in the outer part of the lung. First, CT scans are used to create a virtual bronchoscopy. The abnormal area is identified, and a computer helps guide a bronchoscope to the area so that it can be biopsied. The bronchoscope used has some special attachments that allow it to reach further than a regular bronchoscope.

This takes special equipment and training, and it is not widely available at this time.

Treatment

Surgery

Doctors now use video-assisted thoracic surgery (VATS) to treat some small lung tumors. This procedure lets doctors remove parts of the lung through smaller incisions, which can result in shorter hospital stays and less pain for patients. Doctors are now studying if VATS can be used for larger lung tumors.

In a newer approach to this type of operation, the surgeon sits at a specially designed control panel inside the operating room to maneuver long surgical instruments using robotic arms. This approach, known as *robotic-assisted surgery*, is now being used in some larger cancer centers.

Real-time tumor imaging

Researchers are looking to use new imaging techniques, such as four-dimensional computed tomography (4DCT), to help improve treatment. In this technique, the CT machine scans the chest continuously for about 30 seconds. It shows where the tumor is in relation to other structures as a person breathes, as opposed to just giving a ‘snapshot’ of a point in time, like a standard CT does.

4DCT can be used to determine exactly where the tumor is during each part of the breathing cycle, which can help doctors deliver radiation to a tumor more precisely. This technique might also be used to help show if a tumor is attached to or invading important structures in the chest, which could help doctors determine if a patient might be eligible for surgery.

Radiation therapy

Several newer methods of giving radiation therapy have become available in recent years, For example, some newer radiation therapy machines have imaging scanners built into them. This advance, known as *image guided radiation therapy* (IGRT), lets the doctor take pictures of the lung and make minor adjustments in aiming just before giving the radiation. This may help deliver the radiation more precisely, which might result in fewer side effects.

Chemotherapy

New combinations: Many clinical trials are looking at newer combinations of chemotherapy drugs to determine which are the safest and most effective. This is especially important in patients who are older and have other health problems. Doctors are also studying better ways to combine chemotherapy with radiation therapy and other treatments.

Lab tests to help predict if chemo will be helpful: Doctors know that adjuvant chemotherapy after surgery may be more helpful for some people with early (stage I or II) cancers than for others, but figuring out which patients to give it to is not easy. In early studies, newer lab tests that look at patterns of certain genes in the cancer cells have shown promise in telling which people might benefit most. Larger studies of these tests are now trying to confirm their usefulness.

Other lab tests may help predict whether a lung cancer will respond to particular chemo drugs. For example, studies have found that tumors with high levels of the ERCC1 protein are less likely to respond to chemo that includes cisplatin or carboplatin, while tumors with high levels of the RRM1 protein seem less likely to respond to chemo with gemcitabine. Doctors are now looking to see if tests for these markers can help guide the choice of treatment, so these are not a part of standard treatment.

Targeted therapy drugs

Researchers are learning more about the inner workings of lung cancer cells that control their growth and spread. This is being used to develop new targeted therapy drugs. Many of these are already being used to treat NSCLC. Others are now being tested in clinical trials to see if they can help people with advanced lung cancer live longer or relieve their symptoms. Newer targeted drugs being studied include ganetespib, nintedanib, selumetinib, and custirsen.

Researchers are also working on lab tests to help predict which patients might be helped by which drugs. Studies have found that some patients do not benefit from certain targeted therapies, whereas others are more likely to have their tumors shrink.

For example, a test can find changes in the *EGFR* gene that make it much more likely that a person's lung cancer will respond to treatment with a targeted drug called an EGFR inhibitor. Similar gene tests for other targeted treatments are now being studied. Predicting who might benefit could save some people from trying treatments that are unlikely to work for them and would probably cause unneeded side effects.

Maintenance therapy

For people with advanced lung cancers who get chemotherapy, combinations of 2 chemo drugs (sometimes along with a targeted drug) are typically given for about 4 to 6 cycles. Some studies have found that with cancers that have not progressed, continuing treatment beyond the 4 to 6 cycles with a single chemo drug such as pemetrexed or with a targeted drug may help some people live longer. This is known as *maintenance therapy*. A possible downside to this continued treatment is that people may not get a break from treatment side effects. Some doctors now recommend maintenance therapy, while others await further research on this topic.

Immune treatments

Researchers are developing immunotherapy drugs that can help the body's immune system fight the cancer.

Immune checkpoint inhibitors: Cancer cells can sometimes avoid being attacked by the body's immune system by using certain "checkpoints" that normally keep the immune system in check. For example, cancer cells often have a lot of a protein called PD-L1 on their surface that helps them evade the immune system. New drugs that block the PD-L1 protein, or the corresponding PD-1 protein on immune cells called *T cells*, can help the immune system recognize the cancer cells and attack them.

Nivolumab (Opdivo) and pembrolizumab (Keytruda) are anti-PD-1 drugs that have been shown to shrink or slow the growth of some tumors. Atezolizumab (Tecentriq) is an anti-PD-L1 drug that has also been shown to shrink some tumors. These drugs are now approved for use in advanced NSCLC. They are typically used after certain other treatments have been tried, although pembrolizumab can also be used as the first treatment in some cases.

Other, similar drugs such as MEDI4736 might also shrink some lung cancer tumors. Large studies of these new drugs are now being done.

Vaccines: Several types of vaccines for boosting the body's immune response against lung cancer cells are being tested in clinical trials. Unlike vaccines against infections like

measles or mumps, these vaccines are designed to help treat, not prevent, lung cancer. These types of treatments seem to have very limited side effects, so they might be useful in people who can't tolerate other treatments.

Some vaccines are made up of parts of proteins commonly found on lung cancer cells. For example, the MUC1 protein is found on some lung cancer cells. A vaccine called TG4010 causes the immune system to react against the MUC1 protein. Early research has suggested this vaccine might be helpful when given along with chemo. More studies are planned to see if the vaccine will help patients live longer.

At this time, lung cancer vaccines are only available in clinical trials.

- References

See all references for Non-Small Cell Lung Cancer

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